Geophysical Research Abstracts
Vol. 14, EGU2012-8079, 2012
EGU General Assembly 2012


# Estimating critical water supply for debris flow initiation in Norway

N.K. Meyer (1,2), A.V. Dyrrdal (2,3), R. Frauenfelder (4), B. Etzelmüller (2), F. Nadim (1,4)

(1) International Centre for Geohazards, Oslo, Norway (nkm@ngi.no), (2) University of Oslo, Norway, (3) Norwegian Meteorological Institute, Oslo, Norway, (4) Norwegian Geotechnical Institute, Oslo, Norway

Debris flows frequently affect the Norwegian road and railway infrastructure, especially during spring and autumn. While the debris flow activity in autumn is mainly due to the occurrence of extreme rainfall events, debris flows in spring often occur during periods of rapid snow melt. Existing rainfall threshold values that indicate critical conditions for debris-flow initiation are largely based on precipitation data recorded by meteorological stations. However, during winter the measured amount of precipitation (accumulated as snow) can differ significantly from the actual amount of water that is released to the ground, which is in turn the more critical factor for debris flow initiation. In this study, the data on the actual water supply by the Norwegian Water and Energy Directorate (NVE), and the Norwegian Meteorological Institute (met.no) were used to assess the threshold values. Compared to rainfall data, these data define the hydro-meteorological threshold conditions more accurately throughout the year - i.e. the debris flow triggering conditions due to snow accumulation in autumn and winter and snow melt in spring and summer. Three intensity-duration threshold curves were derived by analyzing the data on 502 past debris flows for water supply durations of 1 to 7 days. Normalization of the data was accomplished using the local "precipitation day normal" to account for regional differences in climate. The minimum threshold indicates the lower boundary above which debris-flow occurrence has been recorded and ranges between 6 and 63 mm/day for different locations and durations. The medium threshold (ranging between 7 and 131 mm/day) characterizes the conditions that are likely to initiate debris flows. Water supply rates exceeding the maximum threshold are regarded as a certain trigger and lie between 12 and 250 mm/day. Based on the obtained threshold curves a frequency analysis over durations of 1, 3 and 7 days for the period 1981-2010 was conducted, indicating the spatial and temporal distribution of water supply events that were the likely triggers for the debris flows. The frequency of past threshold-exceeding events is highest for short durations and along the west-facing slopes of the western and central mountain ranges in Norway. Assuming similar hydro-meteorological conditions, the frequency distribution can also serve as a temporal probability estimation of the future recurrence interval of over-threshold events. Recent debris flow events will serve as test data to verify the model. In the long-term, the obtained thresholds and probabilities will be input to a risk analysis for exposed transport routes, thus helping to identify the temporal probability of partial or total road closure.